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Research: from concept to presentation

How to get your paper accepted for publication

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SUMMARY

This paper is an attempt to convey in a lucid way how to go about writing a scientific article for publication in an appropriate journal. Topics covered *are*: a) reasons to write a paper b) types of papers c) asking a question and formulating an hypothesis d) the complex series of steps necessary before you begin your study e) additional considerations once your study is complete f) the process of writing the paper and g) writing skills. In the concluding remarks I comment on the possibility of rejection of your submission which should not be taken personally. If this does occur it should not deter you from contributing to medical science.

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A few years ago I wrote an article entitled "How to get your paper rejected"[1] which reflected my experience as Editor-in-Chief of Pediatric Pulmonology. In the present paper I take the opposite tack and try to give useful pointers on what makes a good scientific study and a manuscript that editors will want to publish. These thoughts are not only a reflection of my experience as an editor but also are a reflection of my career now extending to about 50 years in the realm of creating and communicating new knowledge in both the basic science and the clinical arenas.

WHY DO YOU WANT TO WRITE A PAPER?

There are many motivations to writing a scientific paper, not all of them philanthropic in nature. As an altruist you may be driven to publish a paper which you feel contain new and novel information that will advance the field of knowledge and that you wish to share with the scientific community. On the other hand, this may be a necessity for completing your training as a subspecialist. For example, research activity has been a requirement of the sub-board of Pediatric Pulmonology of the American Board of Pediatrics since its inception in 1987.[2]

If you wish to be hired by an academic institution, continue to receive grant support from your work or continue to rise in the professorial ranks, then publication is a must in most institutions (the so-called publish or perish paradigm). In recent years skill in teaching has been increasingly recognized as being important and deserving of serious recognition. On the other hand, this skill will not count when you are applying for funds for your research activities. Granting bodies always want to see a publication record in well-recognized journals which gives them some assurance that funds will be appropriately utilized and the aims of the research proposal will be ultimately fulfilled.

TYPES OF PAPERS

There are many types of paper including review articles (state of the art), original articles and case reports. In the journal that I edit, major subtopics of original articles are asthma, cell & animal studies, cystic fibrosis, epidemiology, genetics, neonatal lung disease, pulmonary physiology, respiratory infections, sleep and breathing and a large category of "other" which includes so-called orphan (rare) lung diseases. Reviews are just that, a review of a particular subject which should quote all of the relevant literature in a fair, unbiased but critical way so that the reader is brought up to date on a particular subject and what needs to be done to advance knowledge in the topic area. Case reports are somewhat different. They may be a single patient or a case series and should only be submitted to a journal for publication if there is some substantial new knowledge about the disorder, e.g. has not been previously described, or there has been a novel and successful approach to therapy.

ASKING A QUESTION AND FORMULATING AN HYPOTHESIS

Original articles all have a common starting point: the investigator (in this case, you) begins by asking a question. This is a critical initial step. You have a question and now search the appropriate published literature for an answer. These days this search is relatively easy given the number of search engines and the ease of access to the world's largest medical library, the US National library of Medicine which is a division of the National Institutes of Health.[3] PubMed is their major data base and cites over 20 million publications dating back to the 1950's.

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As pointed out by Audisio et al,[4] there are about 2 million biomedical papers published per year in nearly 20,000 journals. This is a rate of about 5500 new papers per day! What you really want to know before embarking on a study is that this is truly an original idea that you wish to pursue. So, search the literature carefully before embarking on a "me too" study. On the other hand, some confirmatory studies are important, particularly in the clinical arena. What works well in Ushuaia doesn't necessarily apply to Novosibirsk and might require confirmation and/or modification.

A COMPLEX SERIES OF STEPS

You have asked a question that, of course, you know is very important and requires an answer. Assuming that you have the necessary resources to do the research (time, funding, statistical help, space, appropriate patients, access to animal research facilities, an experienced mentor), what now???? The accomplishment of clinical or animal research these days requires a complex series of necessary steps. If you are willing to enter the fray then you really are motivated! Here is a partial listing of those steps:

Write up a protocol which includes numbers of subjects, informed consent paraphrase if human subjects are involved, and methodology. Animal research must include information on anesthesia and precisely how animals are sacrificed (if this is part of the protocol).

Statistical consultation either before or after writing the initial protocol. This is a crucial part of the process in order to avoid a type 2 error which falsely concludes that no difference exists between groups because you have too few subjects to detect a significant difference. It's important to estimate the number of subjects or observations necessary to detect a significant difference (if there is one) *before* you begin the study. Power analysis which helps determine the number of observations (subjects) necessary to detect a certain change is sometimes complex. Here is where the statistician can really help. In addition, overall study design is an area of expertise of a competent statistician.

Submit your protocol to the appropriate Institutional Review Board (IRB) and await their decision. The IRB may send your proposal back for clarification, modification or even reject the proposal on ethical or scientific grounds. You will need to make a statement in the paper that you eventually write that your IRB has approved your study.

If this is a therapeutic clinical trial that you are undertaking then the trial must be registered according to the Consort Protocol.[5,6] At long last, you are now able to proceed with the study that you conceived of many months ago. You collect the data as per the written protocol.

All data are collected and you now proceed to analyze the data. Once again, statistical help may be required at this stage depending on your level of expertise.

You have interesting findings (at least you think their interesting) and you want to present your study at a local or national meeting. Of course, you rely heavily on the expertise and advice of a knowledgeable mentor before you submit an abstract of your work for consideration to the local or national society. Your paper is accepted for presentation and it is well received. You will now proceed (or already have done so) to write a scientific paper for publication.

NEARLY GETTING STARTED

Sterk & Rabe[7] correctly point out that there are several things that should be considered before you put pen to paper (these days it's more likely fingers to keyboard). (Table 1)

Decide to which journal you wish to submit your paper. This requires that you think about the audience who would be interested in reading your paper. A journal devoted to developmental endocrinology is probably not appropriate for a paper on complex pulmonary physiological changes in patients with cystic fibrosis. Also, journals that have an international audience are likely not interested in publishing a paper that has only local or regional significance or interest (e.g. Scuba diving in a particular freshwater lake in Saskatchewan is associated with dermatitis caused by a freshwater mite exclusive to that lake. This may be of interest to clinicians in Saskatchewan but of little interest to Taiwanese readers of the journal).

Table 1
Steps to be taken BEFORE WRITING YOUR PAPER

1. Chose an appropriate journal
2. Carefully read the Instructions to Authors
3. Determine the Authorship of the paper
4. Consider Ethical issues

Carefully read the Instructions to the Authors for that journal. Although there is a general style for most biomedical journals as initially determined by the so-called Vancouver accord of the International Committee of Medical Journal Editors (ICMJE) in 1978,[8] individual journals may differ slightly in detail.

Determine the authorship of the paper. The primary investigator (author) is usually (but not always) listed first on the paper and others may be listed as co-authors if they have contributed in a substantive way to the work. The rules of co-authorship have been carefully spelled out by ICMJE.[8] Briefly, there must be substantial contribution to a) the conception and design of the study and the acquisition and analysis of data b) drafting or rewriting the paper c) final approval of the version submitted for publication.

There are a host of ethical issues involved in writing a paper in addition to the authorship discussed above. Unfortunately, issues such as fabrication of data, duplicate publication, plagiarism, misuse of statistics, manipulation of images and inadequate or blatantly false citations have occurred and keep journal editors alert.[9,10] Of course, none of this applies to you so let's proceed.

FINALLY GETTING STARTED

Before you begin I suggest that you read a paper by Hoppin[11] which is an excellent account of what an expert reviewer is looking for in a scientific paper.

All of us do things a bit differently. The approach used by Sterk & Rabe[7] is excellent but differs from mine. Here is what I do, or at least, used to do when I was actively involved in such things.Write the Methods section first (or Subjects & Methods, as the case may be). This should be written in sufficient detail so that another clinical investigator should be able to easily repeat your work. This section needs to contain a statement about IRB approval for either human or animal studies. For animal studies, details of anesthesia and method of sacrifice are essential to include. If the paper is about a clinical trial, you need to be aware of the Consort statement[5,6] with regard to publication of randomized clinical trials. In the Methods section you need to tell the reader how you determined the sample size (results of the initial power analysis), what statistical tests you used and what level of probability you consider statistically significant, that is, rejects the null hypothesis (e.g. $P < 0.05$). Once you have decided on the level of significance that rejects the null hypothesis, you cannot ignore it. Something is either statistically significant or it is not; there is no such thing as nearly significant (1). The phrase "nearly significant" should never be used in a serious scientific article.

I then go on to write the Results section. This section needs to be presented in detail and with the use of appropriate figures and tables. A lot of information is conveyed in carefully planned tables and figures. Don't use too many acronyms; readers can be easily

Table 2
How to Write Consistently Boring Papers (modified from Sand-Jensen[12])

1. Avoid focus
2. Omit necessary steps of reasoning
3. Avoid originality and personality
4. Use rambling prose and twenty words when five would do
5. Remove reasonable implications and speculations
6. Omit illustrations
7. Use many abbreviations and obscure terms
8. Suppress humor and use dull language
9. Degrade biology to statistics
10. Include too many trivial references

confused by a multitude of acronyms and you need to present your results as clearly as possible. After all, this not a texting or chat line document and needs to be clearly understood by all readers. If it is eventually accepted for publication it will be available for others to read in perpetuity so it has to be impeccable.

Once you are pleased with the Methods and Results section, I suggest you go on to write the discussion. This should begin with several sentences describing the most important new finding(s), followed by a comparison to previously published work and what is similar or new in your findings. You should then provide a critique of your paper—its weaknesses and strengths. Finally, you need to summarize the most important finding(s) and what this means to the particular field of research.

We are nearing the end! You need to now write the introduction. This needs to contain a brief summary of previous work, and a clear statement of the question you are asking or the hypothesis being tested in the present work.

Finally, it is now time to write an Abstract or Summary. Many journals limit the word length of the Abstract so that this may test your writing skills. You may follow the same order as your paper, that is, Introduction (states hypothesis), Methods, Results and Conclusions.

You have written a first draft which you think is fairly good and now send it around to your co-authors for their critique. Sometime later you meet with them or get their written critiques (and there are plenty of them!). You revise the paper accordingly and send the paper back to your co-authors; it is returned with minor comments and once again after addressing the remaining issues, you are ready to submit to the journal you chose. Most of this is now done electronically and you will have to fill out a face sheet with appropriate information as to authors, institution (s), corresponding address, conflict of interest statement etc. depending on the particular journal. Finally, one click of the computer key and your paper has been submitted.

WRITING SKILLS

In a previous paper I enumerated the ten top reasons for getting your paper rejected and near the top of the list was poor writing skills. An ecologist, Kaj Sand-Jensen[12] has published the Top-10 list of recommendations for writing consistently boring publications which I have slightly modified (Table 2).

If English is not your first language, your paper should be checked by a native English speaking scientist for grammar, clarity and proper usage of the language and punctuation. Even an expert might learn something about writing clearly by reading a delightful book by Lynne Truss.[13] If you do not have a native English speaker who can review your paper, read the Instructions to Authors again. Many journals in their Instructions to Authors will direct you to commercially available services which can be utilized. Despite your best efforts, there may be misinterpretation of your precise meaning depending on the cultural and language background of the person who is reading your paper.[14] There are some excellent publications which can help with your writing but require that you actually sit down and read them.[15,16] My approach is that brevity is a cardinal rule, *without* sacrificing logic and clarity.

CONCLUDING REMARKS

After reading this paper you are now an expert on how to publish a scientific article. You submit your paper and there are several possible outcomes: it is accepted outright (rare in my experience so don't make any wagers), sent back for minor revision, returned for major revision or rejected. All of us have had papers rejected that we think are models of excellence. The problem is that no one else thinks so (or at least the 2 reviewers that were sent your paper didn't think so and the editor agreed with them). This is not a personal attack and it's not the end of the world. I will end on an optimistic note rather than saying that maybe it is best that your paper not be published. If you still believe in your work, you may be able to revise it sufficiently and submit elsewhere where you will find a more friendly reception and an appreciative audience.

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